

First record of *Euborlasia nigrocincta* Coe, 1940 (Nemertea: Heteronemertea) from the western Pacific

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ABSTRACT: The heteronemertean *Euborlasia nigrocincta* Coe, 1940 was previously known exclusively from the eastern Pacific. A specimen collected on the Izu Peninsula, Honshu, Japan, herein identified as *E. nigrocincta*, represents the first record of the species from the western Pacific, increasing the western extent of the species' known range by more than 8300 km and indicating an amphi-Pacific distribution.

Euborlasia nigrocincta Coe, 1940 is a bulky ribbon-worm in the heteronemertean family Lineidae. Up to 50–70 cm in body length, individuals of *E. nigrocincta* live in clay or under stones on sandy substrates from the intertidal zone to 30 m depth (Coe 1940; 1944; Friedrich 1970). The species was originally described from California (Coe 1940) and was subsequently reported from Mexico (Coe 1944) and Chile (Friedrich 1970). From the original color illustration by Coe (1940), the species is readily identifiable by its characteristic body coloration in life; its internal anatomy is known only from the Chilean material (Friedrich 1970). Here, based on a single individual found in Japan, we report the first record of *E. nigrocincta* from the western Pacific (Figure 1).

The specimen was collected by SCUBA diving off the rocky shore in front of Izu Oceanic Park (*ca.* 34°53'01"N, 139°07'57"E), Ito, Shizuoka, Japan (Figure 1), on 20 April 2008 from about 10 m depth. It was photographed alive, anaesthetized with a MgCl₂ solution isotonic to seawater, fixed in Bouin's fluid, and preserved in 70% EtOH. Three pieces of the body, including the head, a middle portion, and the tail, were dehydrated, cleared in xylene, embedded

in paraffin, sectioned at 8 µm thickness, and stained with Mallory's trichrome method (Gibson 1994). The specimen has been deposited in the Hokkaido University Museum, Sapporo, Japan (voucher ZIHU 4368).

Our specimen was a mature female; when alive, it was about 20 cm long and up to 0.8 cm wide (Figure 2). The living body coloration consists of a dense speckling of small, irregularly-shaped, dark-brown patches on a beige background. Numerous narrow, darker brown bands are more or less regularly arranged along the body. The body coloration is nearly identical dorsally and ventrally. The head is whitish, sparsely speckled with dark brown patches, and bordered at the posterior margin by a darker brown band (Figure 3). A pair of lateral cephalic slits is present, their posterior ends extending behind the anterior-most dark brown band but not reaching the level of the mouth opening (Figure 3). The animal lacks eyes and a caudal cirrus.

In internal anatomy, our specimen is quite similar to Chilean material described by Friedrich (1970), except that it lacks the intestinal caecum extending anteriorly below the stomach reported in the latter. This morphological difference may represent intraspecific variation or be

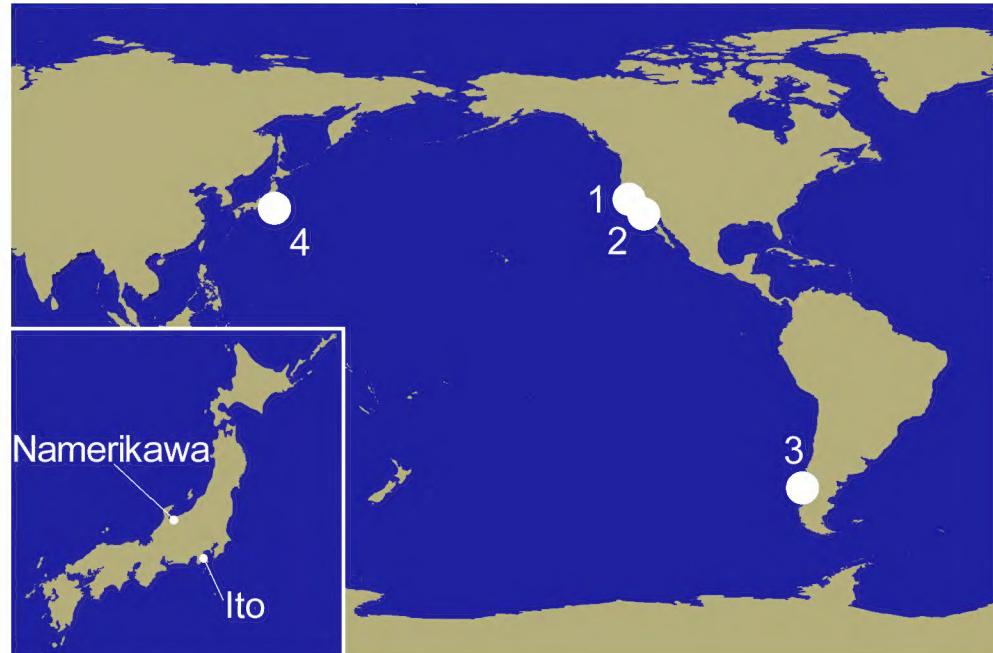


FIGURE 1. Map showing the known distribution of *Euborlasia nigrocincta* Coe, 1940. 1, Monterey Bay and San Diego (Coe 1940), San Francisco Bay (Coe 1944), California, USA; 2, Ensenada, Mexico (Coe 1944); 3, Quenu Island, Gulf of Ancud, Chile (Friedrich 1970); 4, Ito, Shizuoka, Japan (present study); map of Japan, showing the localities where *E. nigrocincta* was found (insert).

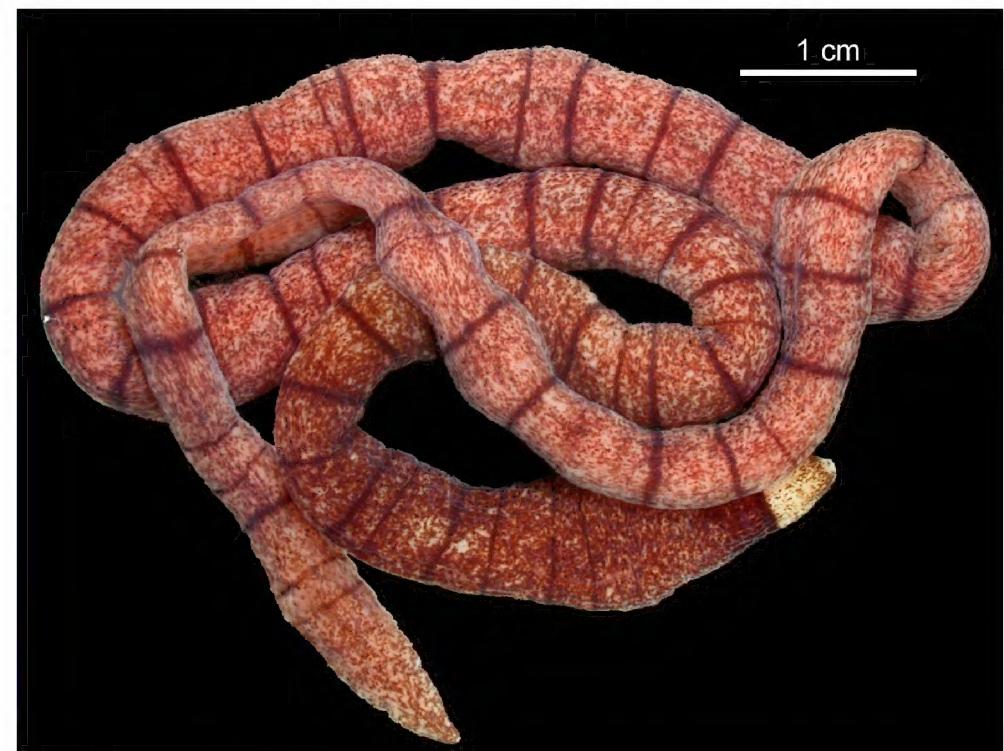


FIGURE 2. *Euborlasia nigrocincta* Coe, 1940, ZIHU 4368 from Ito, Shizuoka, photograph showing the general appearance in life.

due to differences in fixation, unless the Japanese form represents a different, cryptic species. As in the Chilean material, however, the stomach–intestine junction in ZIHU 4368 from Japan is surrounded by circular muscles (Figure 4).

Our specimen has a single muscle cross in the proboscis musculature (Figure 5), as does the Chilean material. Therefore, it differs from *E. gotoensis* Iwata, 1952 and *E. proteres* Iwata, 1957, the two species of *Euborlasia* previously reported from Japanese waters, which both have two muscle crosses (Iwata 1952; 1957). A careful trace of the sections revealed that the muscle cross in ZIHU 4368 is situated on the dorsal side of the organ. The proboscis contains up to five bundles of nerves on both sides, clumped together between the proboscis epithelium and the outer circular muscles. The proboscis epithelium contains clusters of pseudocnidae, which are cigar-shaped and about 9 µm in length; each cluster consists of up to about 20 pseudocnidae.

Friedrich (1970) gave little mention of the structure of the body wall and musculature, except that the dermal glandular layer is separated by a strong connective tissue from the body-wall longitudinal muscle layer. In our specimen, a thin layer of dermal muscles is present directly beneath the epidermal basal lamina (Figure 6A,

B); the muscles appear to be arranged diagonally. As in the Chilean specimen, a layer of connective tissue is situated between the dermal gland cells and the body-wall outer longitudinal musculature (Figure 6A, C). The connective tissue contains a meshwork of diagonal and longitudinal muscles (Figure 6C). Medially, the diagonal muscles and connective tissue become sparser, while the longitudinal muscles denser, as the latter gradually lead to the body-wall outer longitudinal muscle layer. Below it is the nerve plexus, distro-medially wedged between two layers of diagonal muscles (Figure 6D), followed by a well-developed body-wall middle circular muscle layer and an inner longitudinal musculature. In the foregut region, numerous radial muscles are present, terminating at the dermal musculature. Dorsally, their origin seems to be the rhynchocoel circular muscles; laterally and ventrally, most of the radial muscles appear to depart from the foregut wall. The rhynchocoel wall is composed of inner longitudinal and outer circular muscle layers; in the anterior region, the latter is intermingled with longitudinal muscle fibers, especially obvious below the rhynchocoel villus (Figure 6A). This character state has been reported in *Uricholemma nigricans* (Sundberg and Gibson 1995), *Kukumia solomonensis* (Gibson and Sundberg 2002), and *Cerebratulus fuscus* (Chernyshev 2011).

Within *E. nigrocincta*, Coe (1940) recognized intergrading darker and paler color varieties. Our specimen is more similar to the darker variety than to the paler one; the latter is “rosy flesh color, thickly speckled on dorsal surface with elongated reddish brown or purplish dots; with conspicuous purplish brown or black rings encircling the body; ventral surface rosy flesh color; head white or slightly pink” (Coe 1940). Hochberg and Lunianski (1998) designated a neotype among Coe’s (1940) putative voucher specimens, but it is uncertain whether the neotype represents the darker or paler variety.

This is the first record of *E. nigrocincta* from the western Pacific. It increases the western extent of the species’ known distribution by more than 8300 km and indicates an amphi-Pacific distribution.

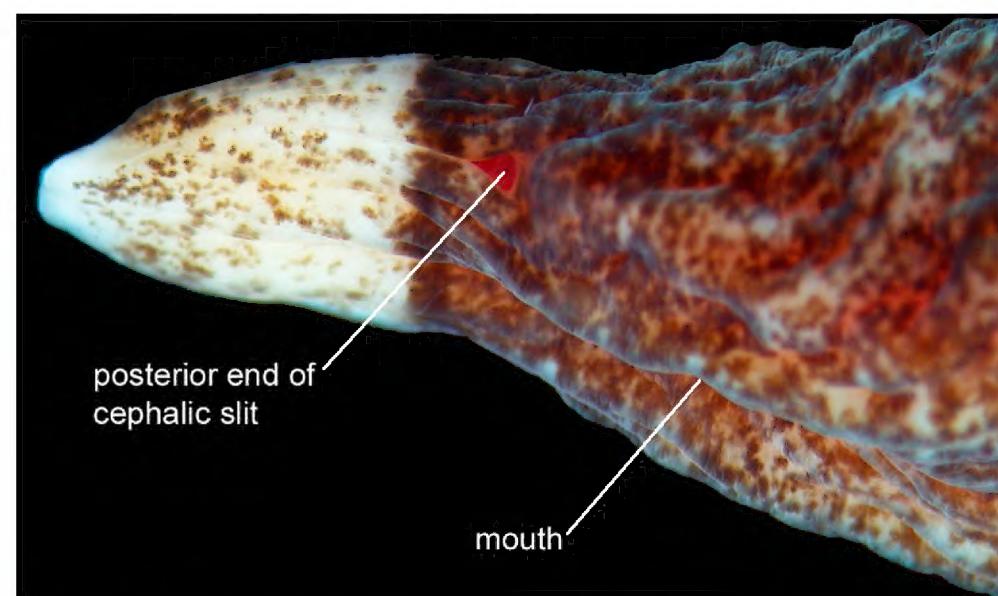


FIGURE 3. *Euborlasia nigrocincta* Coe, 1940, ZIHU 4368 from Ito, Shizuoka, magnification of the head, lateral view, showing the degree of posterior extension of the cephalic lateral slit.

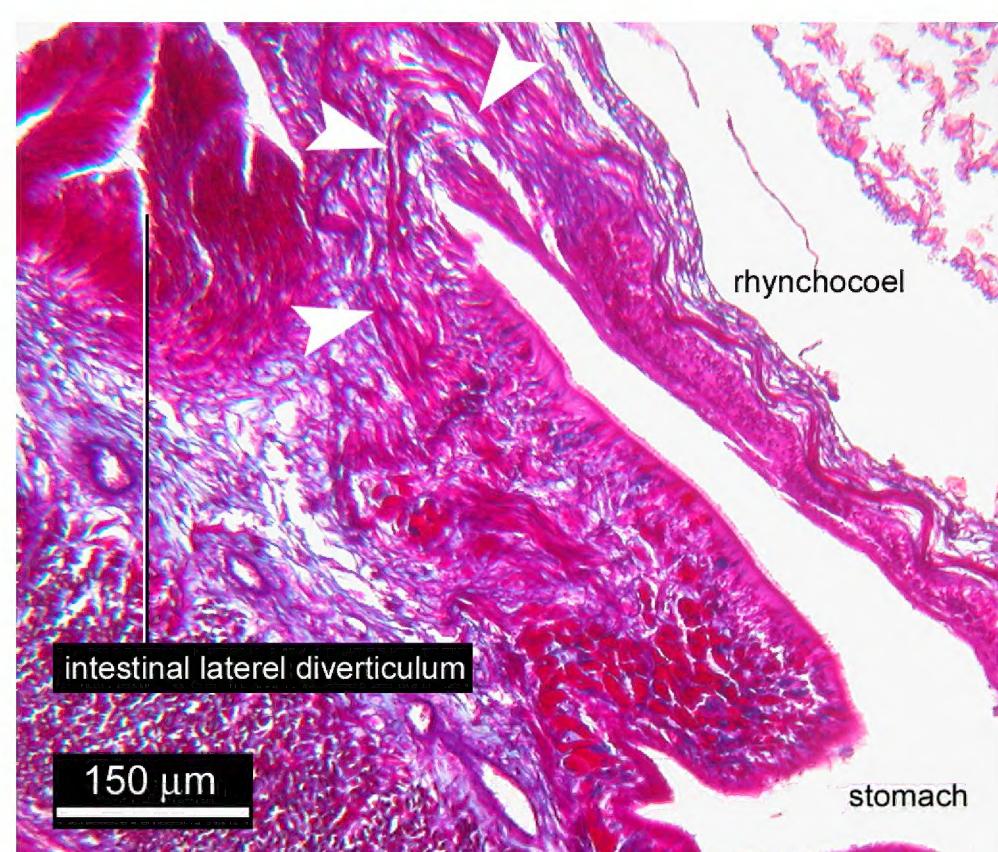


FIGURE 4. *Euborlasia nigrocincta* Coe, 1940, ZIHU 4368 from Ito, Shizuoka, transverse section through the stomach–intestine junction, showing the circular muscles (arrowheads) surrounding the junction.

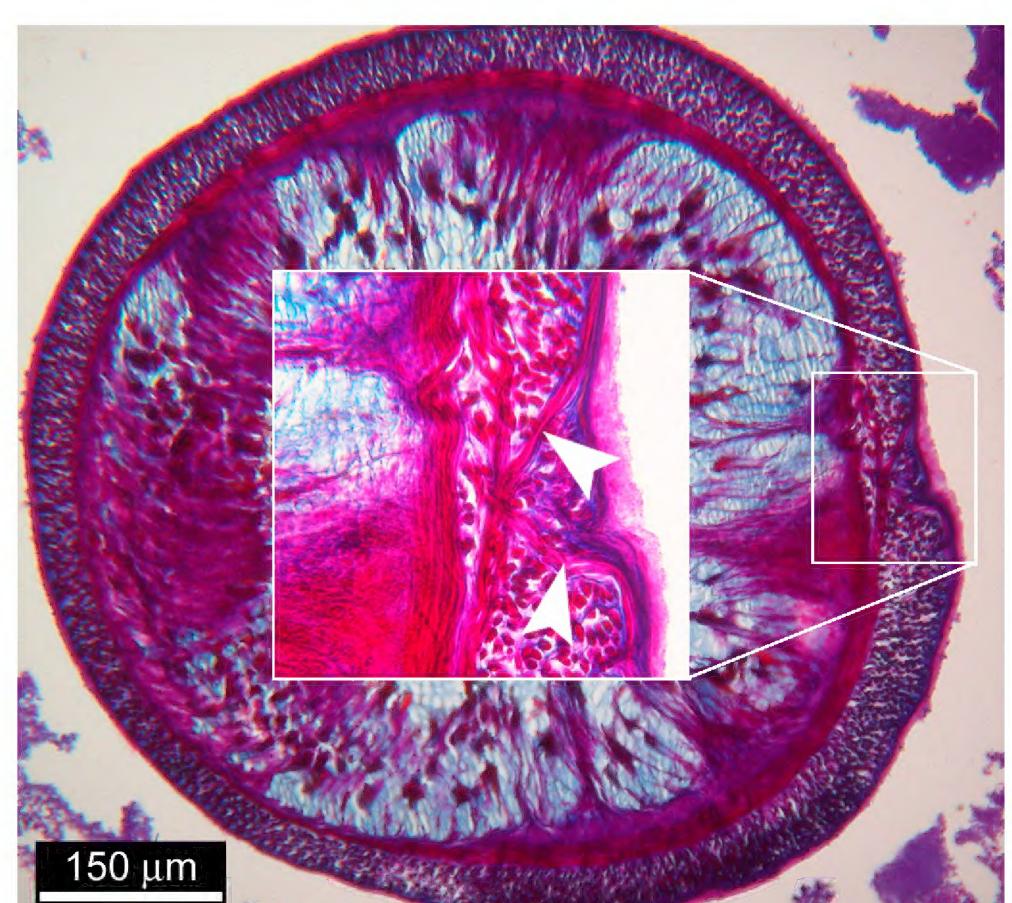


FIGURE 5. *Euborlasia nigrocincta* Coe, 1940, ZIHU 4368 from Ito, Shizuoka, transverse section through the proboscis, showing the single muscle cross (arrowheads) in the magnified inset.

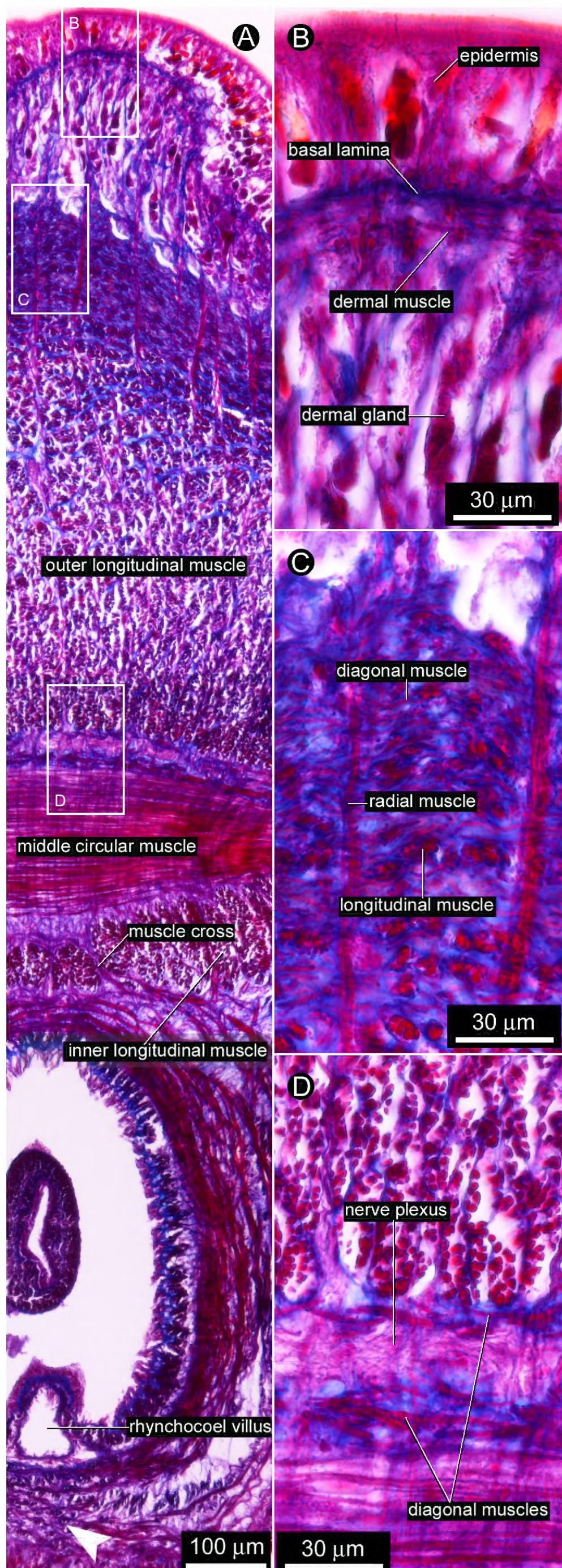


FIGURE 6. *Euborlasia nigrocincta* Coe, 1940, ZIHU 4368 from Ito, Shizuoka, transverse section through the foregut region (A), and magnifications of the epidermis (B), dermal connective tissue (C), and nerve plexus with diagonal muscle layers (D). Arrowhead indicates interwoven longitudinal and transverse muscle fibers in the rhynchocoel.

In addition to ZIHU 4368 from Ito, Shizuoka, another specimen from the Japan Sea coast seems to represent *E. nigrocincta*, judging from the body coloration in a photograph (Figure 7). This specimen, about 10 cm long, was found crawling out from among oysters, *Crassostrea nippona* (Seki, 1934), harvested on 7 August 2003 and placed on the floor of an auction market at Namerikawa Fishing Port ($ca. 36^{\circ}46'32''N, 137^{\circ}20'51''E$), Namerikawa, Toyama, Japan (Figure 2) (S. Wakabayashi, pers. comm.). The ribbon-worm was probably living either among sessile organisms attached on the surface of an oyster shell or in the space among clumped oysters. Unfortunately, this specimen was not retained.



FIGURE 7. A specimen from Namerikawa, Toyama, probably representing *Euborlasia nigrocincta* Coe, 1940. Photograph courtesy of Shin-ichi Wakabayashi.

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LITERATURE CITED

- Chechnyshov, A.V. 2011. *Comparative Morphology, Systematics and Phylogeny of the Nemerteans*. Vladivostok: Dalnauka. 309 p.
- Coe, W.R. 1940. Revision of the nemertean fauna of the Pacific coasts of North, Central, and northern South America. *Allan Hancock Pacific Expeditions* 2(13): 247–322.
- Coe, W.R. 1944. Geographical distribution of the nemerteans of the Pacific coast of North America, with descriptions of two new species. *Journal of the Washington Academy of Sciences* 34(2): 27–32.
- Friedrich, H. 1970. Nemertini aus Chile. *Sarsia* 40(1): 1–80.
- Gibson, R. 1994. *Nemerteans*. Shrewsbury: Field Studies Council. 224 p.
- Gibson, R. and P. Sundberg. 2002. Some heteronemerteans (Nemertea) from the Solomon Islands. *Journal of Natural History* 36(15): 1785–1804.
- Hochberg, F.G. and D.N. Lunianski. 1998. Nemertean collections at the Santa Barbara Museum of Natural History: type specimens and vouchers for Wesley R. Coe's 1940 publication. *Hydrobiologia* 365(1–3): 291–300.
- Iwata, F. 1952. Nemertini from the coasts of Kyusyu. *Journal of the Faculty of Science, Hokkaido University, Series VI, Zoology* 11(1): 126–148.
- Iwata, F. 1957. Nemerteans from Sagami Bay. *Publications from the Akkeshi Marine Biological Station* 7(0): 1–31.
- Sundberg, P. and R. Gibson. 1995. The nemerteans (Nemertea) of Rottnest Island, Western Australia. *Zoologica Scripta* 24(2): 101–141.

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